Gas Laws

① Boyle's Law

P + V @ constant n + T → same speed

(n → same # of particles)

inversely

P↑ V↓

$$\frac{P_1 V_1}{V_2} = \frac{P_2 V_2}{V_2}$$

$$P_2 = \frac{P_1 V_1}{V_2}$$

② Charles's Law

V + T @ constant n + P → same # of collisions

directly

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$v_2 \frac{T_1}{v_1} = \frac{T_2}{v_2} \cdot v_2$$

$$\frac{V_1 T_2}{V_1} = \frac{V_2 T_1}{V_1}$$

$$T_2 = \frac{V_2 T_1}{V_1}$$

T must be in Kelvin

③ Avogadro's Law

V + n @ constant T + P

directly

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

V ↑ n ↑

Ex: A balloon has a volume of 2.1 L (V_1) @ 20. °C (T_1) how big will the balloon be at 100. °C (T_2)?

Given:

$V_1 = 2.1\ L$

$T_1 = 20.°C + 273 = 293\ K$

$T_2 = 100.°C + 273 = 373\ K$

Type: Charles's

HDYK?: only V's + T's

Formula: $T_2 \cdot \frac{V_1}{T_1} = \frac{V_2}{T_2} \cdot T_2$

Solving for:

$V_2 = \underline{\ ?\ } L$

$$V_2 = \frac{T_2 V_1}{T_1} = \frac{(373\,K)(2.1\,L)}{(293\,K)}$$

$$= \underline{2.7}\ L$$